ELECTRONIC FORMS SYSTEMS ANALYSIS AND DESIGN ELECT. FORMS SYSTEMS ANALYSIS AND DESIGN--TITLE PAGE Information Resources Management Technical Guide

ELECTRONIC FORMS SYSTEMS ANALYSIS AND DESIGN

August 1993 Document No. KMP-92-6-R U.S. General Services Administration Information Resources Management Service

Foreward

This handbook was prepared the Information Resources Management Service (IRMS) of the U.S. General Services Administration (GSA) with the assistance of the Ad Hoc Interagency Committee on Electronic Forms Analysis and Design. The Information Resources Management Service (IRMS) of GSA is responsible for developing Governmentwide policy and guidance for automatic data processing, records, and telecommunications management. The common goal of the policies is to ensure that Federal agencies acquire, manage, and use information resources economically and efficiently. The purpose of Electronic Forms Systems Analysis and Design is to provide Federal forms analysts with information on how to analyze electronic forms systems and design electronic forms. It is a guide, not a regulation. We would like to acknowledge and thank those persons who assisted in developing the guidance contained in the "Electronic Forms Systems Analysis and Design" handbook. Franklin C. Stack, management analyst, Matthew Marmor, Team Leader, and Larry L. Jackson, Director, Policy Analysis Division, were the primary authors of the handbook. Members of the Ad Hoc Committee on Electronic Forms Analysis and Design researched and provided information, reviewed drafts, and provided many helpful comments and suggestions. Reviewers within GSA also provided many helpful comments and suggestions. Especial thanks go to Don Page and Doug Arai and their staffs. Inquiries concerning this handbook may be directed to: U.S. General Services Administration (KMP) Washington, DC 20405 Copies of the handbook are available from the IRM Reference Center (reference number KMP-92-6-R). The address and phone number are: IRM Reference Center Room 1231 18th and F Streets, NW Washington, DC 20405 (202) 501-4860

Table of Contents

Chapter 1. Introduction 2. Electronic Forms Systems Electronic Forms Characteristics of electronic forms Electronic forms systems environment 3. Principles of Analysis and Design Comparison to manual forms analysis and design procedures Comparison to Automatic Data Processing (ADP) forms processing procedures User environment considerations 4. Evolution of Design Software Word processing based electronic forms systems Computer based electronic forms systems Database management based electronic forms systems 5. Procedures and Systems for Creating Electronic Forms Procedures Typical system Transfer of existing forms from paper to computers Design of electronic forms Design of electronic forms completions aids 6. Systems Operation Electronic forms distribution Retrieving electronic forms Completing electronic forms Updating databases Retention and disposition considerations 7. Authenticating Electronic Forms Authenticating electronic signatures Electronic signature verification requirements Electronic signature systems operation Protecting confidential or proprietary data Security practices The Freedom of Information and Privacy Acts 8. Summary of Benefits of Forms Automation Glossary Appendices A. Authorities B. Standards Applicable to Electronic Forms C. Paper Standards for Forms Printed on Laser Printers D. Guidelines for the Automation of Standard and Optional Forms E. Checklist of Benefits/Cost Savings for Electronic Forms F. Requirements Analysis Considerations G. Acquisition Method for Software Requirements CD-ROM Publication Note: Figures for the CD-ROM version of this text have been left out, but are available in the hard copy version of the pamphlet from the KAL division of IRMS at GSA.

Chapter 1. - Introduction

Electronic forms systems are becoming more widely available and accepted with each technological advance. They are being integrated with databases, office information systems, and other software systems. As stated in the Foreword, the purpose of this handbook, "Electronic Forms Systems Analysis and Design," is to provide Federal forms managers and analysts with information on how to analyze electronic forms systems and design electronic forms. Basic forms management principles apply to both electronic and manual forms. Chapter 3 of this handbook entitled "Principles of Analysis and Design" discusses these principles and how they apply to electronic forms. The chapter includes the principles presented in the Forms Analysis and Design handbook (National Stock Number (NSN) 7610-00-753-4771) that are valid for electronic as well as manual forms. Forms managers and analysts are finding that their job of creating and revising forms is becoming more complex, but that they are becoming more efficient through the use of electronic form systems. Designing forms is still an art, but much of the labor associated with creating and revising forms has been minimized with the use of electronic forms technology. Mastering the technology requires a working knowledge of personal computer systems as well as forms software. Forms analysts should identify the users information needs before designing an electronic (or manual) form. Once the analysts have identified all required data elements and determined the appropriate amount of space for data entry, they should compose forms that are pleasing in appearance, easy to understand, and organized for efficient and effective data entry. Electronic forms software provides user aids to simplify the forms design and completion processes. Many electronic forms software packages are available, and their number and capabilities are proliferating. Each electronic forms software package has specific systems requirements and operational procedures which apply only to that package. This publication will discuss general systems and procedures for developing electronic forms. Electronic forms systems should be developed in the context of the agency's overall records program and information systems. Electronic forms systems developers require the support of top management. Forms analysts should coordinate the development of electronic forms systems with the originating office, the electronic data processing systems office within the information resources management (IRM) organization, and the potential users of the system. Two GSA handbooks on forms, "Forms Analysis and Design and Forms Management", and the pamphlet, "Electronic Forms and Authentication Practices", are complementary publications to this guide. Electronic forms analysis and design is a continuing process that does not end when the system becomes operational. New electronic forms technologies must be evaluated on a continuing basis to assure that the process is the most efficient and effective that it can be. The expression "If it's not broken, don't fix it" should not apply to the rapidly changing world of electronic forms systems analysis and design.

Chapter 2 - Electronic Forms Systems

An electronic forms system encompasses the totality of resources necessary to develop and complete electronic forms. The resources include development software as part of the electronic forms software resident on forms analysts' computer systems and forms completion software resident on users computer systems. The forms completion software may be linked to databases to provide automated completion of items on forms such as name and address blocks after a unique identifier such as social security number is entered. Electronic forms may be designed to appear the same as forms printed on printing presses through use of graphics software, optical scanners, and font libraries resident on computer systems or font cartridges plugged into laser printers.

Electronic forms

Electronic forms are non-paper, machine-readable forms created by forms analysts with the aid of forms design software. Electronic forms may be stored on and retrieved through compatible computer systems. Forms analysts use forms design software to layout and "map" electronic forms to lead users through the various data elements on electronic forms. Persons who complete electronic forms (users) are provided forms completion software including analyst designed electronic forms. Users may enter

and change data using the forms completion software, but can not revise the electronic forms. Forms analysts may also provide "intelligence" to electronic forms when "mapping" the forms. In other words, forms analysts may not only establish the sequence of cursor movements to lead users through completion of electronic forms, but specify that certain fields (blocks/items on a form) be numeric and others alphabetic and numeric fields to be used for internal mathematical operations. For example, travel costs may automatically be added and placed in the total field of a travel voucher. Forms analysts also may integrate electronic forms with databases. When users complete items on form images displayed on their screens, the databases may be automatically accessed in accordance with the instructions provided by the forms analysts to complete other items on the electronic forms. For example, when a destination is entered into a travel voucher, the per diem rate for the city may be retrieved from a database and included in the equation to automatically calculate the total cost of the trip and enter it in the total block.

Characteristics of electronic forms

Electronic forms are characterized by the following: ù Created by forms analysts with the aid of forms design software; ù Contain a set of standardized, approved data elements associated with a specific set of information; ù Stored on electronic, magnetic, optical, or other electronically accessible media; ù Identified, indexed, searched, or retrieved by electronic means; ù Completed electronically by users viewing images of the forms on monitors; ù Authenticated electronically (e.g., signatures are replaced by electronic substitutes); ù Transmitted electronically; and ù Disposed of by electronic means. (The media on which the data resides, however, may be physically stored in a holding area such as an archive for a period of time in accordance with an agency's authorized retention and disposition schedule.) Electronic forms are also characterized by the following input and output features:

Input

ù Data are entered on standardized screens or screens displayed on a monitor, either by keyboarding or other electronic input devices, such as barcode readers, scanners, or electronic tablets; ù A programmed sequence (logic) governs what pages, screens, fields, and messages are presented to the user during forms completion; and ù Calculations may be performed or additional data retrieved and inserted automatically during forms completion.

Output

ù Electronic output may be available via screens, disks, tapes, optical discs, or other machine-readable media; ù The electronic form, with or without filled-in data, may be printed or displayed on demand from an electronically stored original; ù Printed output from electronic forms may appear to be a preprinted typeset form or simply appear as a typed replica of the form depending upon the software and printer used: or

Electronic forms systems environment

The environment (open or closed) for electronic forms systems often determines the type of electronic forms to be designed and made available. General purpose public use type forms would be more likely to be found on open systems and agency/application specific forms would be more likely to be found on closed systems. Closed systems are generally much easier to control than open systems. Some computer software systems contain an embedded electronic form subsystem. A discussion of open, closed, and embedded systems follows. Open systems are those systems which are open to the general population. The systems administrator and the forms manager do not control access to the system or the distribution of electronic forms. Open systems generally fall into three categories. 1. Open system with prequalification of user systems and assignment of unique PIN and password to users. Example: ù IRS submissions from prequalified tax preparers. 2. Open system without prequalification of user systems, but with a PIN/password. Example: ù Use of commercial telecommunications or database services. 3. Open system without prequalification or PIN/password (no authorization required or

possible). Examples: Example: ù Registration of conference attendees. ù Electronic bulletin board. ù Public message system. Closed systems are those systems which are closed to the general population. Closed systems are generally contained within an organization. The systems administrator and forms manager control access to the system and the distribution of electronic forms to the users. Examples of closed systems are: 1. Physically, technically, and/or operationally controlled systems with pre-qualification of user systems and assignment of unique personal identification numbers (PINS)/passwords. Examples: ù Local Area Network (LAN) within an organization. Users may retrieve forms from the LAN file server. Only the forms manager may place electronic forms into the LAN file server. ù Automated machines accepting encoded identification cards such as bank/credit cards. 2. Controlled user systems with dedicated or prequalified systems. Example: ù Business enterprise with direct dedicated data links to a Federal agency to expedite the procurement and supply process. For instance, Federal Acquisition Regulations (FAR) forms may be completed electronically and the data transmitted via the data links. Embedded systems are those systems integrated with other software systems. Electronic forms software, for example, may be part of a larger software system which also includes a database management system (DBMS) and a word processing software system. Users of this type of embedded system may, for instance, update a database as they enter data into an electronic form. The data may then be used to update a report or personalize a letter which can be composed and printed on the word processing system.

Chapter 3 - Principles of Analysis and Design

Forms analysis and design principles are the same for both manual (or paper) and electronic forms, but the systems and procedures to design the forms will differ and the application of these principles may vary. This chapter will compare the application of these principles to manage and design electronic forms. It will also discuss the user environment considerations that should be addressed when applying these principles. These environmental considerations include the human factors that must be accommodated to have a viable electronic forms system.

Comparison to manual forms analysis and design procedures

The procedures for determining the need for a new form will not vary significantly whether the new form is an electronic or a manual form. In both cases the organization which originates a form and the forms manager decide if a form should be designed and placed in service. As with manual forms, electronic forms should be designed for minimum data entry time to enhance both user convenience and system performance. Electronic forms integrated with or interfaced with a DBMS should use automatic completion to the maximum extent possible. The necessity for questioning each copy may not be as great for electronic forms because electronic forms do not necessarily become paper forms to be maintained in files. Information copies may be transmitted to individuals electronically or reside in a local area network (LAN) for anyone authorized to retrieve a "copy" of the form. The forms may be printed out at the option of the user. Multipart electronic forms containing variations among the parts are created by generating separate electronic forms for each variation. These separate individual parts may be transmitted electronically to the intended recipients. If the recipients cannot receive the form parts electronically, the parts can be printed out and delivered by other means. The ability to decrease work through combining forms is greater with electronic forms. It is easier to produce a combined version of several forms on an electronic form system. Electronic forms integrated with a DBMS often lend themselves to combining because the DBMS permits the elimination of redundant data. Also, redesigning or revising an electronic form is simpler than for a manual form. Electronic forms can be revised quickly and easily by the forms analyst without going through all of the steps associated with manual forms revision.

Comparison to Automatic Data Processing (ADP) forms processing procedures

Processing procedures for electronic forms may be quite different than those for manual forms used in ADP systems. For example, a manual form capturing information for further processing -- such as a data collection form -- would require several more processing steps than an electronic form. Processing manual ADP forms. The processing steps for manual ADP forms may include the following: ù The data are entered into the item boxes on the manual forms by hand. ù The forms are collected, packaged, and delivered to a data entry service bureau. ù The data entry service bureau logs in the documents and places them in batches for processing. ù Transcribers or data entry clerks read and transcribe the data onto data entry form. ù The data entry forms are given to data entry clerks to read and key the data onto a machine-readable media. Since each transcription step can introduce errors, the usual procedure is to validate the data. Validators review the machine readable data and correct any errors which they notice. The validators may be required to contact the people who completed the forms to validate questionable data entries. As a further precaution before the data are processed, an automated error checking program checks the data for reasonableness, proper format, alpha/numeric fields, and other specified criteria to ensure that the database will not be tainted by bad data. Processing electronic forms. By contrast, electronic forms may be completed on-line to a database with built in error checks to ensure that the data are correct. If errors are made, the people who know the most about the data, the users, are alerted while completing the forms and can readily make the appropriate corrections. The savings in processing steps may be significant when compared to those for manual forms. Plus, manual data capture and transcription forms may be eliminated by using the electronic versions of forms. Electronic forms may be more "user friendly" than manual forms. Analysts may include "help" screens to aid users in completing electronic forms. Help screens may provide instructions on how to complete specific items on electronic forms. Forms analysts may also include a user manual in an electronic file integrated with an electronic form. Analysts may provide prompts and edits to remind the users what to do next and to indicate when the users have entered the wrong type of, or unreasonable data into a field. Forms analysts may employ effective screen display techniques such as reverse video to highlight the next field to be completed on an electronic form. User instructions. Forms managers should find it easier to issue instructions to users within an electronic forms system environment. The instructions may be maintained on-line for easy access by the person completing the form. No longer will forms analysts have to create and issue printed instructions on how to complete a form. Readability. As with manual forms, forms analysts should arrange electronic forms for readability. Locations and typography for the items should be consistent to lead the user through the form. Forms analysts can also lead users through electronic forms by specifying cursor movements. Also, forms analysts should select typography for readability. 6-point and smaller fonts should be avoided; they are not readable on computer screens. Fonts should be legible and serve to highlight items on forms. Helvetica type fonts are generally preferred to emphasize captions. Courier type fonts are preferred for data entry on printed electronic and manual forms. Titles, subtitles, and captions should be in upper case. Textual material should be in lower case. On both electronic and manual forms, forms analysts should use action words and effective wording for titles, subtitles, and captions. The words should be simple and familiar to the user. Jargon should be avoided. Forms analysts should avoid complexity; the fewer items on a form or screen the better. Forms identification. Users can identify a printed form more easily than an electronic form. The form number, title, agency, and other identifying information are printed on a paper form. The same data may also be "printed" on an electronic form if it is a facsimile of the paper form. However, electronic forms may not be visible in their entirety on the users' screens. Many electronic forms systems also permit images of forms to be reduced and enlarged on the screen for better viewing. If the screen does not contain identifying information, it may be difficult to identify the screen as a form. Electronic forms are frequently retrieved by the user from a computer directory containing multiple forms. In that case, the user would know the image on the screen represented a form or a portion thereof. If the analyst is aware of the users' screen constraints and operational practices, the analyst may wish to place identifying data for electronic forms on each segment which appears on the users' screens. (Printing of these segment identifiers should be suppressed.) The name of

a file in use, however, will be displayed on users' screens in many computer systems. Users may be able to identify electronic forms by their file names. Electronic form file names on computer systems may be constrained by the number of characters permitted for file identifiers (if each electronic form is contained in a file in a computer system). Forms analysts should be consistent when naming computer files. For example, in the Disk Operating System (DOS) environment, the use of directories and subdirectories adds flexibility in identifying files. User notices. Important notices to form users such as required directions, statements, or instructions on completing the form are more easily fitted into printed than electronic forms due to the possible variances in type sizes. For electronic forms, the number of screens must frequently be increased to accommodate the instructions and notices. Also in the case of electronic forms, the instructions and notices may be integrated with and available through the automated system rather than on the form. Some electronic form systems can also print notices on the back of laser printed forms. Signatures. Providing for original signatures is more easily accomplished with a paper form. Electronic forms are limited to electronic code signatures or computer-generated signature facsimiles. The security and legal validation of the electronic signature must be built into each electronic form system, an action not necessary with paper forms. Alternatively some electronic forms systems use a signature on paper to authenticate their electronic transactions. for example, agencies that use electronic purchase orders in their electronic data interchange (EDI) systems often sign paper contracts with their trading partners and then place electronic paper orders against the contracts. The Internal Revenue Service (IRS) requires taxpayers who file electronically to sign and mail a signature card to IRS to verify that they sent their tax forms electronically. Continuation sheets. Providing for continuation of a form on other pages may be accomplished more easily on some electronic forms systems than on manual systems. Some electronic form systems automatically generate a continuation page and identify item number(s). Transmitting forms. Transmitting a form may be more easily accomplished with an electronic form than a paper form if the person transmitting the electronic form is on the same network as the recipients. The form may be transmitted as electronic mail and appear in the "mail boxes" of the recipients. Stocking forms. Stocking and retrieving blank forms may be accomplished more easily with an electronic forms system. The electronic forms may be placed in a file server of a local area network (LAN) and made available to any authorized user.

User environment considerations

Human factors must be considered when designing electronic forms. Such questions as "Who is the user?" and "What equipment, software, and forms processing systems are available to the user?" must be answered. Data entry screen design is also a key human factors consideration. Whether an electronic form which is the exact facsimile of the printed form should be used as a data entry screen or whether a customized data entry screen should be developed should be analyzed and resolved based on clarity and ease of use. Clarity and ease of use. The data entry screen should rapidly orient the user and convey a clear message as to what information is sought and how and where to enter the data. To achieve the clarity and ease of use, the form or screen needs to be designed with balance, regularity, economy, sequence, and unity to be employed effectively. ù Balance involves the balancing of the screen from left and right and bottom and top. Each portion of the screen design should have equal weight. ù Regularity is the orderly spacing of rows and columns to assist the user in completing the form or screen. ù Economy refers to keeping the screen simple, avoiding excessive use of text or color on the screen. ù Sequence refers to ordering the data entry in a way which would be natural and logical to the person completing the form or screen. ù Unity refers to the "visual hooks" such as consistent spacing between information groups to guide the user and tie the screen or form together. Efficiency. Consideration should also be given as to how the user can save keystrokes and time by accessing on-line files or databases to complete the electronic form after entering some key data.

Chapter 4 - Evolution of Electronic Forms Design Software

Electronic forms design software is rapidly evolving. The first electronic forms were based on word processing, data processing, and computer printing technology. Preprinted specialty forms designed for use on high-speed computer printers with operator intervention to align the form were part of the early

stages of data processing. The forms were designed by professional forms analysts and the programs to print the data on the forms were developed through an electronic data processing organization in the agency or through a contractor. With the introduction of the personal computer (PC) and laser printer, the electronic form as we know it today began to evolve. Forms analysts now design forms on PC systems with the aid of forms design software, and data are entered on PCs electronic media by users with data entry modules of the forms software. Users may print blank or completed copies of electronic on laser printers.

Word processing based electronic forms systems

Word processing systems were the initial platforms used for the creation of electronic forms. This approach has diminished as electronic forms software designed for PCs have proliferated. Most of the electronic forms were user developed for the convenience of users. However, some word processing systems included sophisticated custom designed applications to meet the needs of users whose terminals were linked via telecommunications. The forms images were distributed as word processing documents. Electronic forms produced on word processing equipment are word processing documents. Each word processing generated form must be copied onto the user's system, copied again to add individual data, and printed. They can be electronically mailed to users to store in their word processing files. They can, unfortunately, be revised by any user. (Users of these forms should be directed to make no changes to the forms, only to use them as blank forms.) The data entered into forms created on a word processor cannot be automatically extracted and used directly as input to a data processing system. When users complete forms on word processing systems, they generally print them to provide a paper copy for further processing. The printed forms may then be used as they would in a manual system. They may be filed, used as source documents for data processing applications, etc. The completed electronic forms, however, may be stored in an electronic file and retrieved by users requesting information on individual files. An example of an electronic form produced on a word processing system is shown in Figure 1. The form is the USDA Forest Service Form 6600-1, Cooperative Maintenance Training Request. The limitations become apparent when the form is compared to those created with a forms design software. One can see that this form has the appearance of a format created on a typewriter. Only one font is used on the form and the form is not in block format. There is no "intelligence" built into the form. No totaling or summarizing is done by the word processing program. The burden is on the user completing the form. The user must enter data in all necessary areas and blocks. (Asterisks signify mandatory items. Check block items are not mandatory.) The user is required to place an "x" on the appropriate line to indicate the choice of training. In summary, electronic forms created on word processing systems offer advantages over manual forms, but have severe limitations. The most significant limitation is that the data generated on word processing systems to complete electronic forms cannot be automatically extracted for use with data processing systems.

Computer based electronic forms systems

Computer systems, especially PCs, were the next platform for electronic forms systems. Vendors developed (and are developing) various electronic forms software to operate on specific computer systems. These computer based electronic form systems have the advantage of being supported by vendors who provide training, host user groups, attract new Federal and corporate users, and provide upgrades and other system enhancements. Electronic forms created and maintained on computer systems are created with the aid of electronic forms software packages. The software generally has a forms design module for the forms analyst and forms completion modules for the users. Electronic forms created on computer systems may contain intelligence." Computer based electronic forms systems are often used to capture machine-readable data for further processing by information systems. These systems are also often used to generate copies of electronic forms on demand to avoid stocking paper forms. Error checking routines are often part of electronic form systems data entry modules. Persons who make data entry errors while completing forms are immediately alerted to make the required corrections while the cursor is still on the item in the form on the screen. Figure 2 illustrates a

form created from a computer system and printed on a laser printer with only a single font and no graphics capability. Computer systems in use in Federal agencies often include graphics capability and laser printers with multiple font capabilities to provide users with electronic forms that are facsimiles of the printed form. The advantages of creating and using electronic forms on computer systems are that: ù the electronic forms created on these systems can only be changed by authorized persons; ù edits can be performed on the data, and data can be imported from other files to complete the forms; ù data can be entered and maintained as machine-readable data for processing; and ù in some systems the files may be used to update databases. The primary potential disadvantages of these types of electronic forms systems are that: ù the software is proprietary for each vendor and may not be convertible to other vendors' systems and ù the computer equipment on which the electronic forms are created must be compatible with those of the users. These potential compatibility problems may result in additional conversion work when organizations upgrade their computer and electronic forms systems.

Database management based electronic forms systems

The next step in the evolution of electronic forms systems was to integrate them with database management systems (DBMSs). The DBMSs can immediately provide all or part of the information necessary to complete the forms once the user enters they key identifiers such as organization, name, or social security number. A DBMS may also provide immediate data entry error checks. The data used to complete an electronic form created on this type of system may also be automatically entered into the database after the data are checked for errors. For example, data entered into an electronic personnel form could automatically update the personnel database. Typically, these systems use the American Standard Code for Information Interchange (ASCII) to allow the systems users to import and export data from other automated systems which use ASCII. Forms software integrated with DBMSs can also offer further control over the contents of items on electronic forms through the use of data element dictionaries (DEDs). Each data element (field/item on the form) in a database may be defined in the DED. The DED may include characteristics of the data element, a description of the data element, and its relation to other entities in the database. DEDs contain edit checks to ensure that only data acceptable to the DEDs will be added to the database. Forms analysts need not repeat those edit checks if the electronic forms are on-line to DEDs. Illustration of DBMS based electronic form. Figure 3 (above) illustrates the capability of electronic forms software integrated with a database. Data can be automatically retrieved from the database once the traveler identification is entered. Similarly, the per diem rates can be automatically entered on the form when the cities visited are identified. The calculations may also be automatically performed once the basic data are provided such as the length of stay in a city, tips, and mileage for use of a privately-owned vehicle (POV). The automated electronic travel forms system may include other features associated with travel forms processing. These may include electronic transmission of the completed documents, document tracking, electronic signatures applied by approving officials, data entered into agency accounting systems, and in the generation of automated travel reports. Instructions on how to complete the electronic forms may be available on-line to assist the user. The instructions need not be printed to provide the users with a manual describing how to complete each form. Summary. There are great potential time, energy, and cost savings inherent with using electronic forms systems that are integrated with database management systems. For example, users will save time and effort by having data entered once and stored in a database for later recall and automatic form fill-in rather than entering the same data over and over again. The systems managers are also assured that data entry is consistent from user to user and that data entry errors will be reduced.

Chapter 5 - Procedures ∧ Systems for Creating Electronic Forms

Electronic forms software varies from word processing type software to forms design software with graphic capability. The more sophisticated forms completion software will provide help screens and

automatic insertion of data based on data entered in other items. The completed electronic forms may be more accurate than those completed manually.

Procedures

There are several methods for creating forms. These include scanning existing forms, digitizing existing forms, and creating new forms on the electronic form system. Once the form image is created, the electronic forms analyst may provide "intelligence" to the form by providing edit checks for each of the items on the form and algorithms to calculate numeric values for subtotals and totals. The edit checks may exclude alphabetic characters from items that require numeric responses and vice versa. The edit checks may also establish thresholds for numeric fields to check for reasonableness of the user's responses.

Typical System

Electronic forms design systems used to create electronic forms typically include: ù A personal computer ù A scanner or digitizer ù A "What You See is What You Get" (WYSIWYG) Visual Display Terminal (VDT) screen. (Presentation of information replicates the form as it will appear when printed on paper.) ù A keyboard and/or a mouse for the analyst to use to provide variable information to the forms design software module. ù A laser printer ù Font cartridges (Fonts are available through cartridges which plug into the laser printer) Figure 4 illustrates typical electronic forms design equipment available to Federal forms analysts. The system and media on which the electronic forms will reside may also play a role in the design and development process. Forms which will reside on word processing systems will usually have few edit checks. By contrast, those processing systems or on compact disc-read only memory (CD-ROM) may have many sophisticated edit checks and help features.

Transfer of existing forms from paper to computers

Optical scanning. Optical scanning provides the "eyes" for computer systems. Scanners detect white and black (and gray) dots and translate them into digital data (bits) which the computer system understands. Most forms are line art images with no shades of gray. They can be accommodated by flatbed or sheet-fed scanners similar to photocopiers. Once scanned, the images may be stored on-line and called into the computer memory for reproduction on screens or on paper. Scanning is a rapid way of capturing a form image. Unfortunately, there are several drawbacks: ù A scanned image often is not as precise and sharp as a digitized image drawn with the aid of an electronic forms design package. ù Scanning systems may increase computer memory requirements since both data and blank space is entered into memory. A scanned form occupies approximately a million bytes of storage as every pixel on the raster image must be stored in memory. ù The form may be printed on demand for manual completion by users, but data cannot be entered into the raster image. Digitizing. Digitized forms are machine-readable and for that reason digitizing is the preferred method for capturing form images. The forms may be revised and data entered while the image is on the screen. Many of the systems using digitized forms can also merge data from other computer systems, databases, files, and/or spreadsheets into the forms. Much less computer storage space is required for digitized forms. Only the lines which are "drawn" are digitized. White space is not digitized. Because of their relative simplicity, digitized forms are generally easier to read and print faster than scanned images. Some electronic forms systems employ a two-step process to scan the image and then digitize the scanned image as it appears on the screen.

Design of Electronic forms

Electronic forms design software may provide analysts with many timesaving features. Designer aids and automated forms design aids are often part of electronic forms design software. User aids. User aids may include help messages and menus. Help messages provide guidance to the forms analyst. These messages can be especially useful to analysts learning the system. Menus may be used to

provide the forms analyst with a rapid way of accessing programs integrated into the forms design software and files containing forms. Design aids. Design aids may include automated form layout features such as form grids, rulers, measurements, lines columns, boxes, combs, and leading. Form grids provide useful alignment reference points for forms analysts. Analysts can place lines, columns, boxes, and combs along the form grid to create the form layout. Rulers provide a means for scaling designs. The rulers are displayed on the top and sides of a form's image on a screen. Using the design aids, the forms analyst may specify form dimensions, orient lines in any direction, size and duplicate boxes and columns. Boxes may be created ad moved around on the form and shrunk or expanded. Combs provide the separators within boxes in forms designed to be data entry forms. There may also be features to assist the designer with styles, fonts, leading, graphics, organization identification, title creation, captions, bar codes, fill patterns, copying pages, reducing and enlarging text, and page numbering. Leading, the space between lines of type, may be used to space the characters in the title, subtitles, and captions for boxes. Reducing and enlarging text provides the forms analyst with the capability to emphasize various sections of a form and distinguish between titles, subtitles, headers, and captions. Organization identification may include a logo that was scanned into the system along with stylized initials or the name of the organization in the appropriate font. Once this information is in the system it can be transferred to any form which the forms analyst creates. Graphics can be employed to advantage by the forms analyst to design more pleasing and effective forms. Bar codes may be created through the graphics option to provide a means of identifying the printed form. The form may be tracked, stored and retrieved through scanning technology. Fill patterns may be added to provide shading to highlight fields in a form. Copying pages electronically permits multiple part forms to be created with slight modifications such as page number and recipient. Page numbering provides a means to automatically number pages of multiple part forms. Figure 4a. Forms Design Station

Design of electronic forms completion aids

Electronic forms completion software may reside in a local area network, on a mainframe computer accessed by user terminals, or on the users' PC's. Forms analysts may provide timesaving user features for completing electronic forms. These may include user aids and "intelligence" for the electronic forms. Help screens. Electronic forms analysts may develop "help" screens for each item on the form (fields in the computer system) to describe the item, provide examples of how to complete the item, and provide other guidance to the user. The "help" screen may be developed as a logic tree to permit the user to learn more details about the completion of the item. It may, for instance, include menu items for such topics as item format, laws and regulations which pertain to the item, and acceptable ranges for numerical values. Form mapping. Electronic forms analysts may imbed intelligence into an electronic form through a process called form mapping. This process may include retrieving data from an on-line database using stock numbers or employee identification numbers. It also may involve the creation of algorithms to cause automatic adjustment of total and subtotal fields based on data entries. It may map out the sequences that leads the user through the electronic form. During the process, guidance may be developed to aid users completing the electronic form. Logic provides "intelligence" to a form. If the form says, for example, that all of the next section should be skipped if the answer is "no" to the previous question, the cursor on the screen should move past the skipped section to the next section of the form. Check boxes may be given intelligence to assure that, for instance, only one item in a section of a form may be checked or that if "yes" is checked, "no" cannot be checked. Field definitions are specified by the forms analyst. Definitions would include the name, type, and format for the field. Field formats would include the specifications for the field, such as how many characters does it contain, is the data alpha, numeric, or alpha/numeric. Edit Checks may include test for reasonableness and appropriateness. For example, a person's name could not be entered into a date field on an electronic form without the user being alerted to the error. Limits may also be placed on the range for numeric fields. For example, dollar values over $25,000 could be brought to the attention of the person completing the form. Edit checks are important because persons completing a form can easily revise errors as they enter the data, but attempting to reconstruct and correct errors at a later date can be quite time consuming. The person completing the form also soon learns if he or she is making a consistent error. Calculations may be included in the bit-map of an electronic form. For example, a

travel voucher may be bit-mapped to automatically calculate per diem, cost for travel by privately-owned-vehicle, subtotals, and totals. Figure 4b. Forms Completion Station

Chapter 6 - Systems Operation

Although electronic forms are used within an electronic data processing system, their life cycle is similar to paper forms.

Electronic forms distribution

Rapid distribution of the latest version of forms is facilitated with electronic forms. Forms managers should distribute the latest version of authorized electronic forms to users by methods appropriate to the computer system. If the users are on the same local area network (LAN), the forms manager should maintain the current authorized forms in the file server of the LAN, as a central file server or central processor. If the users have access to the same mainframe computer, the forms manager may place the electronic forms on the mainframe as a central file server or central processor. Forms managers using word processing based systems may use electronic mail to distribute electronic forms to users. If the users have standalone PCs, the forms manager may copy the authorized forms on compatible magnetic media such as floppy disks or optical discs and deliver or mail the copies to users. Agencies which use print-on-demand systems to avoid warehousing and lengthy and expensive reprinting procedures for their forms provide electronically-generated facsimiles of agency forms to users. The number of forms requested by users are printed on high-speed printers and mailed or shipped to the agency users.

Retrieving Electronic Forms

Users retrieve electronic forms through their computer systems. The methodology for retrieval varies depending on the agency's form system and the user's computer system. The electronic forms may be available on LABS, through dial-up modems, or on magnetic or optical media provided to the users by the forms manager for their agency. Users search their computer file listing to locate what should be the latest version of the form. (If the latest electronic forms are provided to the users on electronic media such as floppy disks, it is the responsibility of the user to update their files with the latest version of the agency forms.) Agencies provide print-on-demand blank forms to users just as they would preprinted and warehouse stocked forms. The procedure is transparent to the user. Procedures for providing forms to users for agencies having print-on- demand systems are basically the same as for those having preprinted, warehoused forms. The procedures for stocking and printing the forms are changed. There is no need to stock and warehouse electronic forms. The forms staff fills orders by printing the quantity of the forms that the organization requests and mailing, delivering, or sending the forms by contract carrier.

Completing Electronic Forms

As stated earlier, the forms analyst uses a forms design software module to create the electronic forms for the user. The forms completion software module permits the user to complete the electronic forms and change the data, but not to revise the form, bitmap, or algorithms. (Many electronic forms system vendors separate the forms design and forms completion software into separate software modules to avoid potential problems caused by unauthorized revisions to the electronic forms.) Users with electronic forms completion software may complete the forms on their screens and print them for further processing and manual filing or use the data to update computer files or databases without printing the form. Data entry is accomplished by the user being led through the electronic form by the form bit-map. The cursor moves from field to field on the electronic form on the screen. The user must enter data in the correct format and cannot omit data from "mandatory" fields. The cursor skips over fields which will be automatically calculated and/or completed by the electronic form system. Most total fields, for example, will not be completed by the user. If the electronic form is a word processing document, the user may complete the form and store, transmit, or print the completed form. However,

the data cannot be used to automatically update computer files or databases because it is embedded in the text of the form.

Updating databases

Updating databases is often a byproduct of forms completion.

Some electronic forms systems are integrated with database management systems that reside on the users system. When data are entered in the electronic forms, these data become new records or update existing records within the database. Other electronic forms systems create records and store them on hard or floppy disks. The records on the hard or floppy disks may be transmitted via telecommunications to a central database.

Retention and disposition considerations

Retention and disposition considerations are not necessarily the same for electronic and paper forms. The National Archives and Records Administration (NARA) accepts electronic records only on magnetic tape. The paper version of revised or discontinued electronic forms may be printed and provided to NARA for retention and disposition. The data collected through the use of electronic forms may reside on magnetic or optical media in an agency database or computer file. No paper version of completed forms may exist. The electronic records may be transferred to NARA via magnetic tape. (See Electronic Recordkeeping, July 1989, GPO No. 022-022-00116-0, NSN 7610-01-302- 0666, for a detailed discussion of the disposition of Federal electronic records.)

Chapter 7 - Authenticating Electronic Forms

One of the major concerns of electronic forms system analysts is the authentication of the data or information on electronic forms (including the electronic signature in many cases). To be effective, authentication programs must be part of an overall security program. An agency must ensure that only persons who have a need to know and have the proper delegations of authority and clearances can complete and "sign" electronic forms.

Authenticating electronic signatures

Secure password protection and user identification are the keys to authenticating electronic signatures. Passwords and user identification codes transmitted between PCs or terminals and mainframes in an unencrypted mode are not considered secure methods of generating an electronic signature unless the network is a closed system. For example, a dedicated closed network such as an office automation system with prequalification of users and assignment of unique passwords can be considered a secure system when transmitting electronic mail within the network. The system analysts must determine if the electronic forms system will be an open or closed system. This determination will dictate the authentication method and the security measures needed to safeguard the integrity of the system. In the case of sensitive or classified data, encryption may be used to protect the information on the forms. Encryption should be used for electronic forms signatures to assure that the signature cannot be reproduced without having the proper keys. When encryption is used for unclassified material, it should be done in accordance with National Institute of Standards and Technology (NIST) standards (see FIPS 46.) The National Institute of Standards and Technology (NIST) is in the process of developing standards for authenticating electronic forms and developing prototype electronic forms authentication systems. NIST has a Federal Information Processing Publication (FIPS PUB 161), "Digital Signature Standard (DSS)," in process. The DSS specifies a Digital Signature Algorithm (DSA) appropriate for applications requiring a digital rather than a written signature. The DSA includes signature generation and verification. Generation makes use of a private key to generate a digital signature. Verification of the signature makes use of a public key which corresponds to, but is not the same as, the private key used to generate the signature. If a facsimile of a signature is desired on a hard copy of an electronic form, it can be produced by using scanning devices or biometric pens and graphic

printers. The signature could be stored in an electronic form and reproduced when the document is printed. The signature should be stored in a secure system to assure that it cannot be misused. Although the banking industry does not provide the level of security required for many Federal applications, it does provide a good example of electronic signatures. Banking personnel and the general public use personal identification numbers (PINs) and plastic bank cards with data encoded onto a magnetic strip to authorize bank transactions. Federal finance offices also use this technology to transmit entitlement beneficiary checks and employees paychecks to banks. The banking industry is also experimenting with "smart card" and biometric pen systems which permit users to sign their name to gain access to computer systems and to authenticate transactions. (The computer system "knows" how the person signs their name.) The "smart card" contains the user's signature as well as information about what documents the user is authorized to authenticate.

Electronic signature verification requirements

Electronic signatures should be controlled to ensure security of sensitive and/or controlled documents. The following are suggestions for controls that should be installed in a system using electronic signatures. 1. The data element serving as an electronic signature should be unique to the person authorized to enter the signature into the electronic form. 2. The data element serving as an electronic signature should be entered under password control. The password should: ù Consist of numbers, characters, letters, or a combination of these constructed in such a manner that the password cannot be discovered by unauthorized persons; ù Be unique to the person to whom it is assigned; ù Be safeguarded by the individual to whom assigned; and ù Be changed periodically. 3. Information to be approved or certified through the data element should be the same information that would appear on a signed paper form. It is desirable that a screen display the entire image of the paper form. If not, the information may be arrayed on the monitor in a different way than it appears on the form. All information being approved should be displayed. 4. When requesting approval, the software should indicate on the screen the purpose of the approval or certification requested using the same language as the caption for the approval/certification block on the paper form. 5. Specific statutory provisions make Federal certifying and disbursing officers personally liable for amounts they certify as proper for payment. The guidance presented above is designed for certifying and disbursing officials and is consistent with their responsibilities; however, these officials and agency management should refer also to title 7 of GAO's "Policy and Procedures Manual for Guidance of Federal Agencies" for authoritative guidance on these fiscal activities. 6. Once an electronic signature data element is entered into the computer, it should become a permanent part of the computer file. Retrieval capability should exist to view precisely what data was approved or certified, by whom, and on what date. 7. Once an electronic signature data element is entered into the computer: a. The file should be protected from subsequent change, without detection, by anyone other than the approving or certifying official. b. Alternatively, notification of subsequent changes to the file by another person should be recorded and the change sent promptly to the original approving/certifying official. An inspection to ensure that the subsequent change was necessary and authorized should be initiated promptly. 8. Agencies should establish systems of internal control to ensure that the signature requirements for electronic systems are met. Agencies may establish additional, more stringent requirements for use of electronic signatures when advantageous to the Government. Electronic signature systems operation A typical electronic signature system such as that developed for the Treasury Department's Financial Management Service and those off-the- shelf systems available from vendors for commercial use employ the concept of the public-key cryptosystem developed at the Massachusetts Institute of Technology by Rivest, Shamir, and Adelman in 1977. The system patented by Rivest, Shamir, and Adelman, is not approved by NIST. As stated earlier, NIST is developing a Federal standard for electronic (digital) signatures. In these public-key crytosystems the user creates a public and private key. The private key is used to sign files and open electronic envelopes. The public-key is used to verify the signature and encrypt envelopes containing messages. The users select unique public and private keys. The systems use function keys to permit users to place their electronic signature on a document, verify other signatures, create envelopes, and open envelopes. Envelopes must be addressed with the public-key of the recipients, before the recipients can open them.

Protecting confidential or proprietary data

When electronic forms are placed in a network, the number of users and potential security problems multiply. Safeguards must be installed (with the assistance of the data processing office) to assure that only authorized persons have access to the forms. Several levels of password protection can provide different users with different levels of access. The forms manager, for example, would be the only person authorized to add, delete, or change forms in the file server. Users would be authorized to complete forms. Some forms may be restricted to certain organizations or individuals. Read-only access may be granted to other authorized personnel.

Security practices

PC and workstation users must be reminded periodically to follow recommended security practices . The 1987 Computer Security Act provides for the protection of unclassified, but sensitive, data. Programs to educate and train users on good security practices are necessary. Forms managers may also remind users of security considerations as they relate to specific forms. Some recommended user practices include: * Limit access to your PC or terminal. * Do not disclose your password. * Change your password frequently. * Do not use passwords which are closely identified with you such as your name, address, or initials. * Log off your PC or terminal when you leave the immediate vicinity. * Inspect your data to determine if there have been any unauthorized revisions. * Do not leave classified data in your PC. * Backup your system frequently. Store disks securely and label them with the proper security level. * Always double check your work after you have used a COPY or DELETE command. * Beware of free, or unsolicited software. They may include a computer virus. * Follow Federal Information Processing Standards publications (FIPS PUBS) guidelines. The Freedom of Information and Privacy Acts must be considered when designing electronic forms systems. Users should also be reminded of the Freedom of Information Act (FOIA) and Privacy Act (PA). The FOIA provides any citizen the right to access all Federal records, with certain limited exceptions. The FOIA applies to the entire range of Federal information activities, including agency records stored on electronic forms. The PA is intended to protect personal information stored on Government records and to assist individuals in obtaining information about themselves. The FOIA mandates that the general public be allowed access to Federal files if they have a legitimate need to know and the request does not violate provisions of the Privacy Act. However, the general public is not likely to have access to compatible equipment to access electronic files. Printouts would likely be required to satisfy FOIA requests.

Chapter 8 - Summary Benefits of Forms Automation

Benefits of forms automation are both quantifiable and non- quantifiable. Quantifiable benefits: * Faster, more accurate data entry * Less repetitious input of data * Error reduction * Faster design and redesign * Reduction in printing and warehousing requirements * More efficient filing/retrieving/archiving Non-quantifiable benefits: * Better control over forms and forms design * Faster access to blank or completed forms * No Out-of-stock conditions * Less confusion/aggravation over non-availability of forms * More assurance of having the latest version of a form Time savings. Time savings may come from several variables. It may be faster to enter data on a screen than paper. Changes to a completed form are easier to make electronically and may save retyping an entire form. Electronic verification of entries in fields will reduce data entry errors. Also, automated calculations such as total and subtotal fields reduces errors and saves time. Time can also be saved by merging data from one electronic form to another. Eliminating manual reentry saves time and reduces errors. On-demand printing. When electronic forms technology is adopted, printing, warehousing, and distribution costs may be lowered or eliminated. These savings are possible because an electronic form may not need to be printed or, if a paper copy is required, can be printed on demand at the site where it is needed. This on-site, on-demand printing can eliminate warehousing costs and can sharply reduce distribution cost since only a "master" of the electronic form will need to be distributed and/or transmitted. When demand for a form is uncertain or low, demand printing can reduce costs by avoiding overruns and can eliminate delays due to shortfalls and required reprints. Time saved by

having the form immediately available can also result in savings. Design savings. Potential design savings may be possible since designing forms at an automated workstation is often faster than traditional drafting methods, particularly if the form is often modified. However, "bit mapping" of forms can also be time (and cost) intensive. Distribution, storage, and retrieval. Forms filed on electronic media can be retrieved quickly by number, keyword, or other key terms, resulting in time savings and more efficient operation of the forms program. Also, if forms are distributed electronically, it is easy to ensure that everyone is using the same edition of a form. Depending upon how distribution is managed, it also may be easier to withdraw obsolete or discontinued forms. Only the forms manager needs to take action to effect changes for all electronic forms system users within a network. Archiving of completed forms. Archiving of forms on high- density media may save either the costs of warehousing volumes of paper, or of microfilming, since electronic media can be very cheaply copies to computer tapes or disks. (Some issues remain, however, about the permanence of new media that have not been in use long enough to establish a track record. The National Archives and Records Administration (NARA) is the final authority on the acceptability of various media for storing records.) Appendix E, Checklist of Benefits/Cost Savings for Electronic Forms, provides a framework for evaluating potential applications.

Glossary

Balance involves the balancing of the screen from left and right and bottom and top. Each portion of the screen design should have equal weight. Bar codes may be created through the graphics option to provide a means of identifying the printed form. The form may be tracked, stored, and retrieved through scanning technology. Biometrics Security Devices analyze physical characteristics of an individual to identify him or her to a secure system. The physical characteristics to be analyzed may include a signature signing dynamics, voice, fingerprints, or eye patterns. Bootleg Electronic Forms are electronic forms that are not approved by the forms officer. The electronic forms may be designed by users or obtained from other sources such as integrated software with embedded electronic forms packages. Bootleg forms are not to be created or used. Boxes may be created directly with this electronic forms package feature and moved around on the form and shrunk or expanded by the forms analyst. Calculations may be included in an electronic form. For example, an electronic travel voucher may be programmed to automatically calculate per diem, cost for travel by privately owned vehicle, subtotals, and totals. Captions (or labels) for fields may be placed above or beside fields on an electronic form by a forms analyst. They can not be revised by the users. Check boxes may be given intelligence to assure that, for instance, only one item in a section of a form may be checked or that if "yes" is checked, "no" can not be checked. Closed systems are those systems which are closed to the general population. Closed systems are generally contained within an organization. The systems administrator and forms manager control access to the system and the distribution of electronic forms to the users. Columns may be sized and duplicated on a form to create the design. Combs provide the separators within boxes in forms designed to be data entry forms. Copying pages permits multiple part forms to be created with slight modifications such as page number and recipient. Economy refers to keeping the screen simple, avoiding excessive use of text or color on the screen. Edit checks can be added to form fields to assure that only answers that meet the editorial criteria will be accepted. Edit checks may include tests for reasonableness and appropriateness. For example, a person's name could not be entered into a date field on an electronic form without the user being alerted to the error. Limits may also be placed on the range for numeric fields. For example, dollar values over $25,000 could be brought to the attention of the person completing the form. Edit checks are important because persons completing a form can easily revise errors as they enter the data, but attempting to reconstruct and correct errors at a later date can be quite time consuming. The person completing the form also soon learns if he or she is making a consistent error. Electronic Data Interchange (EDI). The computer-to-computer interchange of standardized business documents. Electronic Forms consist of electronic print images of the forms and their corresponding forms templates and maps. For the purposes of this document, electronic forms are defined as those forms which reside on magnetic or optical media. Characteristics include: ù Computer-aided-design and revision ù Print-on-demand ù Data may be added, changed, or deleted on forms screen to complete forms ù User access controlled by systems

managers Electronic Forms Analysis and Design is the process of creating electronic forms on electronic data processing systems. Electronic Forms Mapping is the process of creating the edits, rules, and algorithms which control the data entry process for electronic forms. This may include automated calculations, highlighting invalid entries, etc. Electronic Forms Systems. Systems that use electronic forms, to include: software, personal computers or a mainframe computer, and terminals connected via a network. Electronic Forms Templates are the images on the screen presented to the user completing the electronic forms. Templates may be an exact image of the form or may be data entry screens designed to capture the variable data for the forms. Electronic Print Images are the forms printed on laser or other computer controlled printers. The printed forms may include data. Electronic Recordkeeping. For the purposes of this document, electronic recordkeeping is defined as the operation of recordkeeping systems in which a computer interface is required for the user to create, work with, or delete records. Examples of electronic records are records residing on magnetic tapes, disks and drums, video files, and optical discs. Field is the electronic data processing term for an item on a form or a data element in a database. Fields form computer records. Fields contain data which may be stored in computer files or databases. Field definitions are specified by the forms analyst. Definitions would include the name, type, and format for the field. Field formats would include the specifications for the field, such as how many characters it may contain, and is the data restricted to alpha, numeric, or alpha/numeric characters. Fill patterns may be added to provide shading to highlight fields in a form. Fonts (type faces) may be selected to provide for the most pleasing and effective forms design. Form means a fixed arrangement of captioned spaces designed for entering and extracting prescribed information, including ADP systems forms. Form grids provide useful alignment reference points for forms analysts. Analysts can "snap" lines into place along the form grid to create box designs and rows and columns. Form mapping is the process that the forms analyst goes through when embedding intelligence into an electronic form. This process may include retrieving data from an on-line database based on stock numbers or employee identification numbers. It also may involve the creation of algorithms to cause automatic adjustment of total and subtotal fields based on data entries. It may map out the sequence that leads the user through the electronic form. During the process, guidance may be developed to aid users completing the electronic form. Graphics can be employed to advantage by the forms analyst to make for more pleasing and effective forms. Help Messages provide guidance to the forms analyst. These messages can be especially useful to analysts learning the system. Forms analysts may also develop electronic "help" screens for each item on the form (Fields in the computer system) to describe the item, provide examples of how to complete the item, and provide other guidance to the user. This "help" screen may be developed as a logic tree to permit the user to learn more details about the completion of the item. It may, for instance, include laws and regulations that may be viewed by the user when he selects from the help menu for that item. Leading is used to space the characters in the title, subtitles, and captions for boxes. The spacing is controlled by the forms analyst through commands to this menu item. Lines are the basic structure feature for designing forms. The analyst can orient them in any direction o the form to create boxes, columns, and spaces. Lists may be generated as menu items for form fields. The user of the form may then select an item from the list of choices to complete the item on the form. Logic provides "intelligence" to a form. If the form says, for example, that all of the next section should be skipped if the answer is "no" to the previous question, the cursor on the screen should move past the section to the next section of the form. Measurements is an electronic forms design software feature which permits a forms analyst to specify the dimensions of a form. Menus is an electronic forms design software feature which may be used to provide the forms analyst with a rapid way of accessing programs integrated into the forms design software and files containing forms. Numbering pages provides a means to automatically number pages of multiple part forms. Open systems are those systems which are open to the general population. The systems administration and the forms manager do not control access to the system or the distribution of the electronic forms. Organization identification may include a logo that was scanned into the system and stylized initials or the name of the organization in the appropriate font. Once this information is in the system it can be transferred to any form which the forms analyst creates. Pixels are the measure of the resolution of a raster image on a visual display screen. The greater the number of pixels per screen, the higher the resolution. Raster Images are those scanned into the computer system. The image is formed by a pattern of closely spaced rows of dots called pixels. Reducing and enlarging text provides the

forms analyst with the capability to emphasize various sections of a form and distinguish between titles, subtitles, headers, and captions. Regularity is the orderly spacing of rows and columns to assist the user in completing the form or screen. Rulers provide a means for scaling designs. The rulers are displayed on the top and sides of the image on the screen. Sequence refers to ordering the data entry in a way which would be natural and logical to the person completing the form or screen. Sizing boxes is a feature that permits the analyst to shrink or enlarge blocks on a form. Styles can be used to select the proper style for the overall form. A style book may be crated for a series of forms. Title creation permits the analyst to specify the fonts and the size of titles, subtitles, and captions. Unity refers to the "visual hooks" such as consistent spacing between information groups to guide the user and tie the screen or form together.

Appendix A - Authorities

The creation, maintenance, and disposition of all official records, regardless of media, is controlled by the provisions of 44 U.S.C. Chapters 21, 29, 31, and 33; the Federal Information Resources Management Regulation (FIRMR) (41 CFR Chapter 201); and NARA regulations in 36 CFR Chapter XII, parts 1220 - 1238. 36 CFR 1234 establishes the basic requirements relating to the creation, maintenance, use, and disposition of electronic records. The Paperwork Reduction Act of 1980 (44 U.S.C. 35) and the Paperwork Reduction Reauthorization Act of 1986 (P.L.99-500) calls for the coordination and integration of ADP, telecommunications, and records management policies. All three of these elements are present in electronic form systems. To implement the above laws and regulations: o The Administrator of GSA is required to provide guidance and assistance to Federal agencies to ensure economical and effective records management by such agencies. (44 U.S.C. 29) o The Archivist of the United States is required to provide guidance and assistance to Federal agencies with respect to ensuring adequate and proper documentation of the policies and transactions of the Federal Government and ensuring proper records disposition. (44 U.S.C. 2904). o Agency heads are required to: o Make and preserve records containing adequate and proper documentation of the organization, functions, policies, decisions, procedures, and essential transactions of the agency and designed to furnish the information necessary to protect the legal and financial rights of the Government and of persons directly affected by the agency's activities (44 U.S.C. 3101). o Submit records disposition schedules to the Archivist of the United States for approval. No record may be destroyed without the authorization of the Archivist (44 U.S.C. 3303, 3303a.3314).

Appendix B - Standards Applicable to Electronic Forms

The following five Federal Information Processing Standards (FIPS) Publications may be applicable to electronic forms. 1 FIPS PUB 46 (Data Encryption Standard) 2 FIPS PUB 64 (Guideline for documentation for computer programs and automated data systems in the initiation phase) 3 FIPS PUB 83 (Guideline on user authentication techniques for computer network access control) 4 FIPS PUB 102 (Guideline for computer security certification and accreditation) 5 FIPS PUB 112 (Password usage) 6 FIPS PUB 113 (Computer data authentication) 7 FIPS PUB 146-1 (Government Open Systems Interconnection Profile (GOSIP)) 8 FIPS PUB 161 (Electronic Data Interchange (EDI)) For further information about these and other related FIPS publications contact the National Institute for Standards and Technology (NIST). Copies of FIPS PUBS may be ordered from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161; (703) 487-4650 The American National Standards Institute (ANSI) Standards organizations which pertain to electronic forms are: 1 ANSI X9 Banking (Password Protection/Access/Authentication) 2 ANSI X3 Information Processing 3 ANSI T1 Telecommunications (Transmission) 4 ANSI X12 Electronic Data Interchange (EDI) (forms) Some of the ANSI X12 standards for EDI which may pertain to electronic forms include the following: 1 ANSI X12.1 Purchase Order 2 ANSI X12.2 Invoice 3 ANSI X12.3 Data Element Dictionary 4 ANSI X12.4 Payment Order/Remittance Advice 5 ANSI X12.5 Interchange Control Structure 6 ANSI X12.6 Application Control Structure 7 ANSI X12.7 Request for Quotation (RFQ) 8 ANSI X12.8 Response to Request for Quotation 9 ANSI X12.9 Purchase Order Acknowledgement 10 ANSI X12.10 Shipping Notice/Manifest 11 ANSI X12.11 Order Status Inquiry 12 ANSI X12.12

Receiving Advice 13 ANSI X12.13 Price/Sales Catalog 14 ANSI X12.14 Planning Schedule with Release Capability 15 ANSI X12.15 Purchase Order Change 16 ANSI X12.16 Purchase Order Change Acknowledgement 17 ANSI X12.18 Shipment Information 18 ANSI X12.20 Functional Acknowledgement 19 ANSI X12.22 Data Segment Directory 20 ANSI X12.23 Order Status Report 21 ANSI X12.24 Financial Information Reporting 22 ANSI X12.25 Customer Account Analysis 23 ANSI X12.26 Product Transfer Account Adjustment 24 ANSI X12.27 Price Authorization Acknowledgement/Status 25 ANSI X12.28 Inventory Inquiry/Advice 26 ANSI X12.30 Order Status Inquiry 27 ANSI X12.33 Product Transfer and Resale 28 ANSI X12 34 Text 29 ANSI X12.37 Shipping Schedule 30 ANSI X12.38 Lockbox 31 ANSI X12.41 Report of Test Results 32 ANSI X12.42 Cryptographic Service Message 33 ANSI X12.43 Operating Expense Statement 34 ANSI X12.50 Response to Product Transfer Account Adjustment 35 ANSI X12.56 Interconnect Mailbag Control Structures 36 ANSI X12.58 Security Structures International Standard ISO 9735, Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT) containing application level syntax rules is the most widely accepted international standard for EDI. Documents defining both the X12 and EDIFACT families of standards are available from the Data Interchange Standards Association (DISA), 1800 Diagonal Road, Suite 355, Alexandria, VA 22314; (703) 548-7005

Appendix C - Paper Standards for Forms Printed on Laser Printers

Various Government regulations impact the type and quality of paper that agencies may use. For instance, the Environmental Protection Agency requires agencies to use paper containing 50 percent recycled paper. The General Services Administration recommends 32 or 40 pound bond with a 25 percent rag content in Government memorandum and letterhead paper. These regulations may cause problems when implementing electronic forms systems. Electronic forms systems use laser printers for printing forms on demand. These printers require a very smooth sheet to absorb the toner, and the smoother the paper, the sharper the image. Copier (xerographic) paper can be used for laser printers, but there is paper designed for use in laser printers. Laser printer paper should be used for such applications as creating print masters or to produce a sharper, more impressive document. Laser printer paper should be smooth for sharp image and therefore requires heavier paper to obtain the required stiffness to transport properly through laser printers. Copier paper should be 20 pound bond and laser printer paper 24 pound bond. Letterheads and logos may be printed on laser printer paper prior to generating the image on paper or they may be scanned into the system and generated on the laser. Since Federal logo generation may slow down the printing of the form as the logo is formatted and printed, at least one agency has specified that the agency logo not appear on electronic forms.

Appendix D - Guidelines for the Automation of Standard ∧ Optional Forms

FIRMR (41 CFR) 201-9.202-1 requires each agency to obtain GSA approval for each new, revised, and canceled Standard and Optional Form, and exception thereto, prior to implementation, using Standard Form 152, Request for Clearance or Cancellation of a Standard or Optional Form or Exception. GSA recommends that agencies promote the use of electronic versions of Standard or Optional Forms.

Electronic generation of Standard and Optional Forms

In concert with the progress of applying new technology to the use of forms, the General Services Administration (GSA) has developed guidance on the process of obtaining approval for automating Standard and Optional Forms. Federal agencies may create and use electronic versions of most Standard and Optional Forms without exception approval provided each form conforms to the current guidelines contained in FIRMR Bulletin B-3. The Bulletin will be updated when appropriate to reflect or reference GSA's most current guidance in this area. Agencies should refer to the most current

version of Bulletin B-3 for additional information. At the time this handbook was developed, the guidelines were as follows: 1. Before starting an electronic forms initiative the agency should review the "List of Standard and Optional Forms Not To Be Electronically Generated" in Attachment A to FIRMR Bulletin B-3. Forms listed in that attachment may not be electronically generated without specific exception approval by GSA. 2. The electronically generated Standard or Optional Form must be complete, containing all instructions and questions which appear on the current official form. The wording and punctuation of all items, instructions, and identifying information must match exactly. No data elements may be added or deleted. The sequence and format for each item on the form must be reproduced to the highest degree possible. Each item must print on the same page in approximately the same location. However, forms printed face and back on the original may be printed on single sheets providing each page is identified with the form number, page number, and edition date. Likewise, multiple part sets may be printed as single sheets. The final form must be printed using the same dimensions as the current edition is printed. All blocks must remain approximately the same size and lines must remain approximately the same length. Consult with the promulgating/sponsoring agency for possible variations in box and paper sizes, paper color and/or special ink and paper, and line lengths. The electronic form should contain the software name and vendor/producer (if any) at the bottom of the face page. 3. The accuracy of electronically generated Standard and Optional Forms is the responsibility of the form implementor. Revisions must be implemented properly and promptly. 4. Information on the current version of the form may be obtained by consulting the Standard and Optional Forms Facsimile Handbook, the Inventory of Standard and Optional Forms, and the Standard and Optional Forms Management Program (GSA/KMR) personnel at GSA. 5. It is important to verify that forms produced from standard software have not been altered by the computer system. Identical software used on different system configurations can produce forms that may look the same but may be slightly different. 6. Any form with poor print quality or other defect which renders it illegible or very difficult to read will not be acceptable. Laser printers or near letter quality printers may be used to print electronic forms. Dot-matrix printers that are only capable of producing draft quality documents shall not be used for form generation, but may be used for filling in a preprinted form where appropriate. 7. In the case where electronic versions contain unanticipated defects which are not specifically described in these guidelines, the Federal agencies (to include the Liaison Representative in the promulgating or sponsoring agencies) have the right to reject the forms as implemented. Upon rejection, any problems regarding the acceptability of a specific electronic version of a particular Standard or Optional form shall be brought to the attention of all concerned Federal agencies' Liaison Representatives, the vendor (if any), and the Standard and Optional Forms Management Program (GSA/KMR) personnel. 8. Electronically generated Standard and Optional Forms that do not conform to these guidelines must be cleared as exceptions.

Appendix E - Checklist of Benefits/Cost Savings for Electronic Forms

Potential Cost and Time Savings

1. Savings on the design/redesign of forms a. How much time does it take to design the form now? b. How much time does it take to revise or redesign the form now? c. How much time would it take to design the form using an electronic forms design system? d. How much time would it take to revise or redesign the form using an electronic forms design system? 2. Printing cost savings a. What is the current cost to print the form? b. What will it cost to generate the form on demand using the proposed output technology? 3. Savings in warehouse costs a. What is the cost of stocking, restocking, and otherwise warehousing the paper form? b. How many forms become obsolete and are disposed of annually? c. What is the cost of maintaining the forms in electronic files? 4. Savings in shipping costs a. What is the cost of distributing the paper form? * Administrative costs * Shipping costs 5. Data entry a. Will data entry time be reduced? If so how much? * How much time is saved by the elimination of the need to align the form in a typewriter/printer? * How much time is saved during

forms completion because of more efficient data entry and error correction? b. Will error rates be reduced through the use of automatic edit checks on fields? If so, * How much more reliable are the data? * How much error correction time is saved or avoided? * How many incorrect paper forms are destroyed when the manual system is in use? c. How much time will the automatic calculation of numeric total and other calculated fields save? d. How much time will be saved by the automatic completion of fields by the system? e. When some or all of the data on a form is revised or corrected, is there a time savings? * How much time is spent entering changed data on portions of the electronic form? * How much time is saved by avoiding reentering unchanged data on the electronic form? 6. Elimination of duplicate data capture a. Are data from the form used by others? If so, * How much time or money is spent rekeying or otherwise recapturing this data? * How much time or money is spent correcting or reconciling rekeyed data? b. Will automation of data entry eliminate the need to collect the same information on more than one form? 7. Savings by transmitting data/form electronically a. How many people need to see the form? b. What are their locations? c. If the form were transmitted electronically, would there be savings in photocopying, mail, and messenger service, and filing and retrieving the form? 8. Savings on use of forms a. How much time is saved through more rapid completion? b. How much time is saved through more rapid retrieval? 9. Savings in filing, retrieving, and archiving completed forms a. What is the annual filing volume? b. What is the cost to file a paper form? c. What is the cost to file an electronic form? d. How often is the form likely to be retrieved? e. What is the retrieval cost for paper forms? f. What is the retrieval cost for electronic forms? g. Is the form to be archived? h. What is the cost of archiving paper forms? i. What is the cost of archiving electronic form?

Possible Intangible Savings

1. The data on the form may be more reliable and accurate. 2. Data on forms will be available more rapidly. 3. Databases may be updated as forms are completed. 4. Control over data on the forms may be improved. 5. User dissatisfaction over nonavailability of data and forms will be decreased or eliminated 6. Forms analysts and computer systems analysts will work together to develop the electronic forms system, increasing the chance for improved cooperation.

Possible Intangible Costs

1. Availability of technology may encourage users to develop unauthorized forms. 2. Control of storage, retention, and disposition of completed forms may be difficult for the records manager.

Costing an Electronic Forms System

To calculate the total cost of designing, installing, and operating an electronic forms system, one must aggregate the following costs: design (new/converted/scanned) costs; user hardware and software costs; training costs; additional security and authentication costs; and increased personnel/consultant costs due to the need for more technical expertise. 1. System costs ù Compare costs of developing custom in-house software and purchasing "off-the shelf" software. (FIPS Pub 64 requires that agencies consider alternatives). Use cost of selected alternative. ù Customized in-house forms design software provides agency with ownership of the system; the option of modifying the software to meet changing requirements; and the right to distribute as many copies among its staff and other agencies as desired. (Unlimited distribution to other organizations, however, may not be feasible because of incompatibilities among the custom software and other organization's systems.) ù Proprietary software available "off-the-shelf" from vendors provides rapid installation and expert support. The initial cost may be lower, but additional copies will add up. Site licensing may be explored as an option. ù Calculate the cost of all new equipment and equipment modifications necessary to install and operate the electronic forms system. ù Ensure that the system has sufficient memory. ù Determine what additional equipment the system requires. ù Include cost of all additional hardware and software needed for all potential users. ù Telecommunications ù Determine the quantity and types of telecommunications required to service potential system users. ù Ascertain if existing networks can be used. ù Determine quantity of additional telecommunications equipment required. 2. Installation of

electronic forms system ù Calculate cost designing/redesigning/scanning existing forms onto the electronic forms system. ù Determine the cost of potential users resistance to change. ù Determine the cost of transitioning from the old to the new system in terms of inconvenience and disruption of routine operations. ù Cost of ensuring availability of necessary expertise to redesign electronic forms. ù Cost of designing/revising an electronic form. 3. Forms completion costs ù Determine percentage of time the system is used for the electronic forms application and the cost of that usage. ù Calculate increased completion costs if higher graded or more personnel are required to complete electronic forms. (For example, if a clerk completes the paper form, but a professional/manager completes the electronic form, the completion cost basis will differ.) ù Determine cost of "goodwill" of user-friendly or non-user-friendly system. 4. Training/retraining costs ù Calculate training and retraining costs. ù Calculate cost of travel to training sites. ù Determine cost of trainees time away from office. 5. Security/authentication costs ù Calculate any new costs necessary to secure and verify/authenticate data on electronic forms. ù Determine cost of electronic form authorization system in lieu of handwritten signatures.

Appendix F - Requirements Analysis Considerations

FIRMR 201-20.1 sets forth the policy for analyzing agency requirements. Requirements analyses should be commensurate with the complexity and size of the requirements. When planning the procurement of an electronic forms system, in accordance with the FIRMR requirements, the following specific items should be considered: user needs; the needs of the forms office; the compatibility of the electronic form system under consideration with the existing and planned computer systems of the user organizations, and the funding for the systems.

User needs

As in any automated or manual system, to be effective the system must be designed to meet user needs. Electronic forms systems should include separate functions to allow the forms analyst to create form images and to permit the users to complete forms created by the forms analyst. The system should allow the users to add, revise, and delete data on the forms, but should not allow the users to alter the forms. Users should be able to access and complete the forms without formal training on the system. The users need a system which is easy to learn and use. Electronic forms should offer field edit checks and prompts to assist the user. Where feasible, electronic forms should automatically complete sections of the form from calculated totals and data stored on-line in a database. For example, an employee completing a travel voucher using some electronic forms systems may only enter variable data such as his/her name, taxi fares, locations visited, and the duration of the stay at each location. The electronic forms system would automatically provide the traveler's mailing address, work location, per diem rates for each location, and other predefined information from a database and calculate subtotals and totals.

Forms office needs

The forms office needs a system to design and maintain forms easily. The system should include help screens to assist the forms analyst. The best system for design purposes are those that include a high-resolution monitor that displays the entire form. The system should also include appropriate output devices for the services provided by the forms office. The printers may include laser printers for camera ready copy, dot matrix printers for drafts, and large production printers for "Printing-on-demand." The electronic forms system must allow the forms analyst to amend, delete, or add forms under the control of the forms office. The forms office or agency must have a system to produce backup records to use when the computer system on which the electronic forms software resides is inoperable or when an individual record cannot be located or accessed. The electronic forms system should have the capability to list all electronic forms by such categories as date of request or approval, name of requestor or approval authority, or subject matter. The forms office should maintain these listings in accordance with the agency approved retention and disposition schedule.

Compatibility with other user systems.

Compatibility with other user systems is a key issue when considering electronic forms systems. Compatibility concerns must be addressed by the analyst in the requirements analysis. Agencies must consider the consequences of vendor-supplied electronic forms systems that may contain proprietary software which cannot be changed to accommodate user systems. If the ability to change forms systems is a requirement, this must be considered when defining the software needs.

Funding/Cost considerations

The amount of funding available, or expected to be available will have an impact on the type system to be acquired. This will be a major consideration in the analyzing alternatives in accordance with FIRMR 201-20. The electronic forms software should be relatively inexpensive.

Analysis of Alternatives

All feasible alternatives and estimated costs for the system should be considered (see FIRMR 201-20.203-1 and -2). Site licensing should be investigated as an alternative to purchasing software for each user. This may allow copying and use of the software by multiple users within an organization. The expected life cycle costs of the electronic forms system should be considered when acquiring electronic forms software. The cost may be amortized over the life of the system. (See Appendix E. Checklist of Benefits/Cost Savings for Electronic Forms for further cost considerations.)

Appendix G - Acquisition Method for Software Requirements

After agency needs are defined, the method of acquisition must be considered. If a market analysis indicates that there are systems available that will already meet the need, systems development may not be required. This could simplify the procurement process, especially if the acquisition is one of a small dollar value. For small dollar acquisitions, small purchase procedures may be used for those up to $25,000. The GSA schedule may also be used for acquisitions under $25,000, but can be used for those with higher dollar value, as long as it is under the schedule maximum order limitation (MOL). For larger dollar buys or where development work is needed, a solicitation will need to be issued. Solicitations for electronic forms software should be based on agency needs. The mandatory requirements should state the basic needs of the agency. Desirable features may be included but if they are, their value to the agency must be stated (e.g., dollar value or points to be added to score). Desirable features are those features that may have some value to the agency, but are not essential to the system and which, if offered, must be evaluated. An offer cannot be rejected, however, if desirable features are not offered. If offered, a proposal may receive added value. A solicitation for an organization's electronic forms software may include some of the following technical factors. The list includes features that may be part of the mandatory requirements or may be included as desirable features with stated values to the agency. ù Ease of installation ù Menu driven ù Able to specify modifications ù Ease of learning ù On-line reference manual ù Written reference manual with an index and a table of contents ù Tutorial on-line ù Error alerts (beeps/messages (with reference)) ù Ease of use ù Menu driven ù Options displayed on screen ù Mouse support ù Cursor key support ù Function key support ù Help screen ù Undo function ù Visual design ù Trace feature ù Graphics file support ù Postscript support ù Grid available ù Wide selection of fonts ù Output ù Screen ù File formats compatible with agency computer systems ù Electronic mail/telecommunications ù Electronic forms saved to magnetic or optical media ù Data entry ù Validation edits ù File formats compatible for importation of data from other computer files ù Automatic completion of fields ù Prompts for user ù Cursor movement to next item to be completed by the user ù Unalterable form image ù Data alterable by authorized user The software should be tested for a period of time prior to full-scale implementation, either before or after award. Consideration must be given during the solicitation stage as to how this will be done, and testing procedures written into any solicitation.